Partial Branching Ratio

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23 Oct., 2008

Abstract

The partial branching ratio in region I ($p \in [205.1, 227]$ MeV) is $(0.489^{+0.446}_{-0.291}) \times 10^{-10}$. The partial branching ratio in region II ($p \in [130, 205.1]$ MeV) is $(2.91^{+4.02}_{-1.79}) \times 10^{-10}$.

1 Region I and II

Kp2 peak is used as the division of region I and region II. Kp2 background is an important background for pnn1 and pnn2 study. To suppress this background both pnn1 and pnn2 study selected their kinematics signal box to be away from Kp2 peak, which is above 2.5 times the resolutions of momentum, energy and range. The advantage of using Kp2 peak as the division is that all the events selected in pnn1 or pnn2 study are kept in their big region I or II. The relative acceptance of cells within one study does not change. What's left is just a universal factor to scale up acceptance and scale down prediction.

As shown in Fig. 1 the momentum range of region I is [205.1, 227] MeV and range of region II is [130, 205.1] MeV. Due to trigger conditions pion track with momentum less 130 MeV will completely fail $3ct \cdot 4ct \cdot 5ct \cdot 6ct$. 205.1 MeV is Kp2 peak and 227 Mev is the end point of the standard model (SM) predicted momentum spectrum.

This division strategy is verified by a MC study. MC signal event are generated with nuclear interaction and pion, muon decay turned on. Target scattering may cause wrong momentum measurement in UTC that means some high momentum track will get into low momentum range and it cannot just be explained by resolution. Besides trigger and UFATE etc. and some solid angle cuts described in Table 78 of K074 some target scattering cuts are also applied to further suppress scattered track. They are tgdedx, epitg, tglike, eiccon, tgenr, npitg, rtdif, drp, chi567, angli, tgpv and ccdpul. The applied chi567, angli and tgpv are very loose with respect to the version used for data since they are not well simulated in UMC. The energy cut of ccdpul is from MC truth information like used in the Ke4 and CEX analysis in E949 pnn2 study. rsdedx and rngmom are also applied as a setup cut. The momentum truth distribution of selected events is shown in Fig. 2. No event is below 130

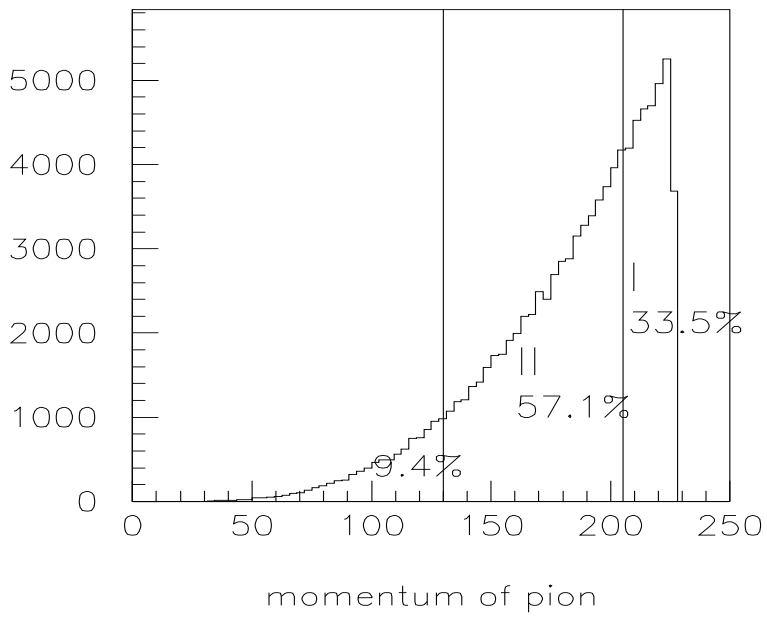

Figure 1: Region I and II. The histogram is the SM predicted momentum spectrum. Region I and II are marked by the two vertical line. The number in each region is the fractional area comparing to the total spectrum.

MeV and just a few events are left above kp2 peak. These a few event are caused by the pion nuclear interaction. A set of normal target cuts are thought to be able to remove them. Even they won't be removed this division strategy is still valid because they can be ignored safely.

2 Partial branching ratio

The latest predicted branching ratio is $(0.85 \pm 0.07) \times 10^{-10}$ [1]. As shown in Fig. 1 for region I the prediction is scaled down by 33.5% and 57.1% for region II. On the other hand for region I the acceptance of each cell are scaled up by 1/33.5%, while the acceptance of each cell in region II are scaled up by 1/57.1%. All pnn1 studies are combined to give the partial branching ration in region I and all pnn2 studies are combined for region II. The prediction and calculated partial branching ratios are tabularized in Tab. 1

Table 1: Predicted and measured partial branching ratio

$(\times 10^{-10})$	SM prediction	measurement
region I	0.28 ± 0.02	$0.489^{+0.446}_{-0.291}$
region II	0.49 ± 0.04	$2.91^{+4.02}_{-1.79}$

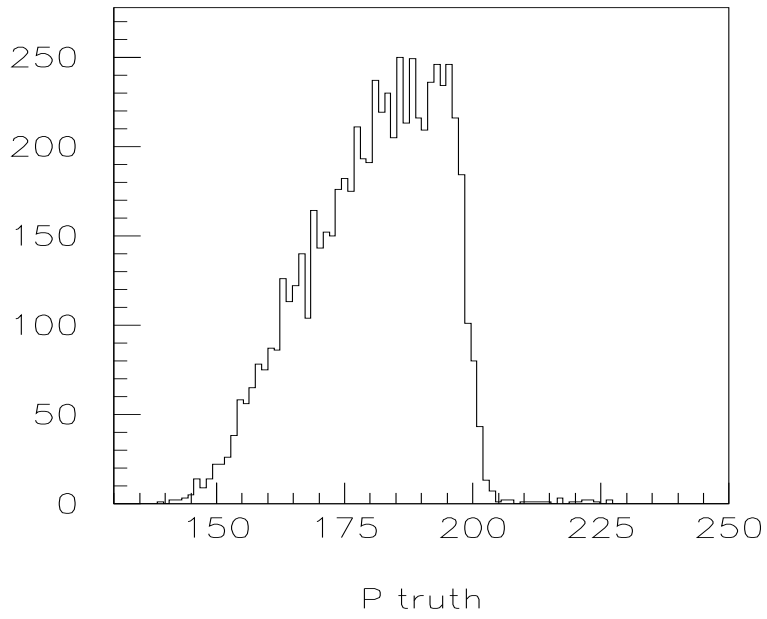

Figure 2: Momentum truth of selected MC pnn2 events

References

[1] J. Brod and M. Gorbahn, Phys. Rev. D78, 034006 (2008), arXiv:0805.4119